

REMARKS

By this Amendment, Applicants have amended the claims to more clearly define their invention. In particular, Applicants have amended independent claim 1 to recite that the connection between the substrate and the electronic circuit element, that is, the connection between the chip electrode of the electronic circuit element and an internal electrode of the substrate and the peripheral connection, is made by gold-tin (Au-Sn) bonding. See, e.g., page 15, line 22 to page 17, line 12 and page 10, lines 12-26 of Applicants' specification. Applicants have also added claims dependent claims 19-29, independent claim 30 and dependent claim 31 to further define their invention. Independent claim 30 recites that a sealing member is formed between the first surface of the electronic circuit element and the second surface of the substrate to surround the first electrode in the first surface and the second electrode in the second surface, and the sealing member has an alloy including tin (Sn) and gold (Au) being formed therein and having a melting point higher than the melting point of tin. See, e.g., page 10, lines 12-26 and page 14, line 21 to page 21, line 9 of Applicants' specification and Figures 1-3.

Claims 1-5 and 7 stand rejected under 35 U.S.C. 102(b) as allegedly being anticipated by U.S. Patent 6,498,422 to Hori. Claims 6, 8 and 9 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Hori. Applicants traverse these rejections and request reconsideration thereof.

The rejected claims relate to, as shown by way of example only in Figures 1-3, an electronic device comprising a substrate 200 and an electronic circuit element 100 flip-chip connected on the substrate. A connection is made by gold-tin bonding 400, 341 (210) between a chip electrode 120 of the electronic circuit element 100 and an internal electrode 210 of the substrate 200. This connection is sealed

between the electronic circuit element 100 and the substrate 200 in a peripheral connection also formed therebetween by gold-tin bonding 410, 341 (213). Thus, an alloy containing gold and tin is formed in each of the connection and the peripheral connection.

New claims 30 and 31 are directed to an electronic device in which a sealing member is formed between the first surface of the electronic circuit element and the second surface of the substrate to surround the first electrode in the first surface and the second electrode in the second surface, the sealing member having an alloy including tin and gold formed therein and having a melting point higher than the melting point tin.

The Hori patent discloses an electronic component comprising a substrate having a surface on which an electrode is formed and an SAW circuit element having a surface on which a circuit is formed. A bump electrode joins the circuit on the circuit element and the electrode of the substrate together, and a sealing material joins the circuit element and the substrate together in the periphery of the space between the circuit-forming surface of the circuit element and the substrate. The Examiner refers to Figure 4 of this patent which shows a conventional SAW device in which the seal rings 35 and 38 are made Au. On the other hand, the embodiment of the invention of Hori shown in Figures 5A and 5B is described to use a sealing material 63 which is a soldering material formed of Sn or Pb as a principal ingredient. However, nowhere in Hori is it disclosed that an electronic circuit element is connected on a substrate with a peripheral connection formed by gold-tin bonding, as presently claimed.

The gold-tin bonding now specified in the claims achieves an air tight encapsulation of the electrical connection between the electronic circuit element and

the substrate without raising the processing temperature as high as gold-gold bonding requires. By employing gold-tin bonding, molten tin may react with the gold at the peripheral sealing portion to form the gold-tin bond. This gold-tin bond can include a gold-tin intermetallic compound. The melting point of the gold-tin intermetallic compound is higher than the tin melting point of 232°C. Therefore, even when secondary reflowing for mounting other components is performed in later steps, remelting of the peripheral connection is prevented. See, e.g., page 19, line 10 to page 20, line 22 of Applicants' specification.

Moreover, the gold-tin bonding can be finished without the gaseous emissions which would occur during soldering with the tin solder taught at column 6, lines 33-37 of Hori.

Thus, the present invention achieves advantageous results not achieved by either the conventional SAW device disclosed in Hori or the SAW device of the embodiments of Hori. Accordingly, the presently claimed invention is neither disclosed nor suggested by Hori.

Applicants note the Examiner has cited a number of documents as being pertinent to Applicants' disclosure. However, since none of these documents has been applied in rejecting the claims formerly in the application, further discussion of these documents is deemed unnecessary.

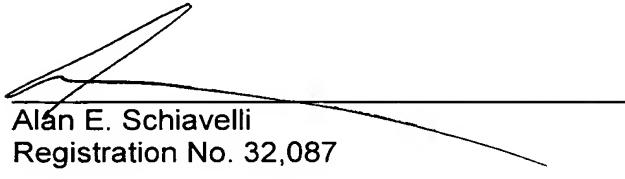
In view of the foregoing amendment and remarks, favorable reconsideration and allowance of all of the claims now in the application are requested.

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Respectfully submitted,

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